REMARKS/ARGUMENTS

Claims 27 and 30-37 are pending in the application.

Claims 27 and 30-37 are rejected under 35 USC §103(a) as being unpatentable over Koning (6,365,973 cited by applicant) in view of Iino et al. (6,207,259).

An advantageous feature of the present invention is that the pads of a semiconductor device and pads of a substrate are bonded to each other by Cu balls, Cu_6Sn_5 and Cu_3Sn. All of the Cu balls, and Cu_6Sn_5 and Cu_3Sn material have high melting points. Therefore, even when the bonding is subjected to high temperature after the bonding process, the bond remains.

In accordance with conventional bonding techniques, parts are bonded using temperatures around 260°C. Cu balls have a melting point temperature of 1080°C and CuSn compounds have a melting point temperature about 630°C. These melting point temperatures are higher than typical bonding operation temperatures. The present invention can obtain this mixture of Cu balls and CuSn compounds.

The amended claims recite a bond junction including a Cu-Sn compound containing Cu_6Sn_5 and Cu_3Sn and Cu balls resulting from a mixture of said Cu balls and an Sn-based solder subjected to a bonding operation at a temperature above the melting point temperature of said Sn-based solder but less than the melting point temperature of said Cu balls. When the bonding operation is performed on the Cu ball and Sn-based solder mixture, the bonding temperature melts the Sn-based solder. The Sn reacts with the surface of the Cu balls in an irreversible reaction to create the CuSn compounds. The resulting mixture of Cu balls and the CuSn compounds forms bond junction that is not susceptible to the processing temperatures during further processing of the device.

Koning describes a coating 124 for an electrically conductive filler 122 that includes copper and solder material 116 including Sn, Cu, and compounds thereof. The disclosed Sn, Cu, and its compounds are only included in the solder material 116. It is not correct to interpret this as solder material comprising Cu-Sn compound, since Cu-Sn compounds

have a melting point higher than bonding temperature melting points and is thus unsuitable for use in solder material for electronics devices.

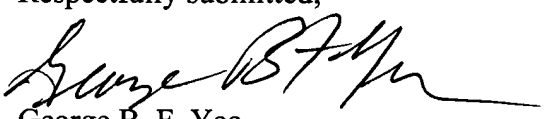
Koning discloses the use of Cu as a coating material and Cu-Sn compounds are included in the junction. However, Koning does not disclose pads are bonded to each other by Cu balls and CuSn compounds, as recited in the pending claims.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



George B. F. Yee
Reg. No. 37,478

TOWNSEND and TOWNSEND and CREW LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
Tel: 650-326-2400
Fax: 415-576-0300
GBFY:srb
60555813 v1